

Serial No.: 10/749,394
Docket No.: 103-1002
Amendment dated December 7, 2006
Reply to the Final Office Action of October 10, 2006

Amendments to the Claims

The listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A charging apparatus used with a mobile robot, comprising:
a rechargeable battery and a contact terminal included in the mobile robot; and
a charging unit including a plurality of charging terminals at least one of which is brought into electrical contact with the contact terminal of the mobile robot to supply a charging current to the rechargeable battery of the mobile robot, each of the charging terminals comprising,
a body comprising an insulating material, and
a head movably coupled to the body, and having a contact plate mounted on a predetermined portion of the head to be brought into electrical contact with the contact terminal of the mobile robot.
2. (Original) The charging apparatus according to claim 1, wherein the plurality of charging terminals are arranged in a plurality of rows.
3. (Original) The charging apparatus according to claim 1, wherein each of the charging terminals further comprises:
a support shaft to support the body; and
an elastic member to restore the body to an original position thereof.
4. (Original) The charging apparatus according to claim 1, wherein the body comprises a groove, and the head extends from the groove to be integrated with the body in a single structure.
5. (Original) The charging apparatus according to claim 1, wherein the charging unit comprises an electrical cable coupled to an external power source, and each of the charging terminal comprises an electrical connecting member embedded in the body and the head to electrically connect the contact plate to the electrical cable.

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6. (Withdrawn) The charging apparatus according to claim 1, wherein each of the charging terminals comprises a coupling unit to couple the body to the head.

7. (Withdrawn) The charging apparatus according to claim 6, wherein the coupling unit comprises a metal plate.

8. (Withdrawn) The charging apparatus according to claim 6, wherein the coupling unit comprises a metal pin.

9. (Withdrawn) The charging apparatus according to claim 6, wherein the coupling unit comprises a coupling rod which has a ball at an end thereof.

10. (Original) A charging apparatus used with a mobile robot having a rechargeable battery and a contact terminal, comprising:

- a casing;

- a terminal mounting board disposed on the casing;

- a charging circuit connectable to an external power source;

- a guide groove formed on the terminal mounting board; and

- a charging terminal comprising,

 - a body having a first support member to be inserted into the guide groove, and having a second support member extending from the first support member to protrude from the terminal mounting board, and

 - a head movably coupled to the second support member of the body, and having a contact plate mounted on a portion of the head and electrically connected to the charging circuit.

11. (Original) The charging apparatus according to claim 10, wherein the charging terminal further comprises:

- a groove portion formed on the second support member between the portion of the head and the first support member.

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12. (Original) The charging apparatus according to claim 11, wherein the first support member moves in a direction parallel to the guide groove, and the groove portion of the second support member has an area perpendicular to the direction parallel to the guide groove, the area being smaller than at least one of an area of the portion of the head and an area of the second support member.

13. (Original) The charging apparatus according to claim 12, wherein the area of the groove portion of the second support member is smaller than an area of the first support member.

14. (Original) The charging apparatus according to claim 10, wherein the charging terminal further comprises:

an elastic member disposed between the terminal mounting board and the body of the charging terminal so that the first support member slides along the guide groove of the terminal mounting board.

15. (Original) The charging apparatus according to claim 10, wherein the first support member, the second support member, and the head are formed in a monolithic single body.

16. (Original) The charging apparatus according to claim 10, wherein the body comprises:

a through hole formed to pass through the body from the first support member to the portion of the head; and

an electrical cable disposed in the through hole to be electrically connected to the contact plate and the power code.

17. (Original) The charging apparatus according to claim 10, wherein the first support member of the body moves in a first direction while the head moves in a second

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direction.

18. (Original) The charging apparatus according to claim 10, wherein the first support member moves in a first direction along the guide groove, and the head moves in a second direction different from the first direction when the contact terminal of the robot moves toward the contact plate in a third direction different from the first and second directions.

19. (Original) The charging apparatus according to claim 10, wherein the first support member of the body and the head moves in different directions with respect to the terminal mounting board and the body, respectively, when the contact terminal of the robot is not disposed on a line passing through the guide groove and a center of the robot.

20. (Withdrawn) The charging apparatus according to claim 10, wherein the charging terminal comprises:

a coupling member coupled between the second support member of the body and the head so that the head elastically moves with respect to the body.

21. (Withdrawn) The charging apparatus according to claim 20, wherein the charging terminal further comprises:

a through hole formed to pass through the first and second support members of the body;

an electrical cable disposed in the through hole to be electrically connected to the coupling member and the power code; and

another electrical cable connecting the contact plate and the coupling member.

22. (Withdrawn) The charging apparatus according to claim 10, wherein the charging terminal comprises:

a pin coupled between the second support member of the body and the head so that the head can move with respect to the second support member, and electrically connected between the power code and the contact plate.

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23. (Withdrawn) The charging apparatus according to claim 22, wherein the charging terminal comprises:

a through hole formed to pass through the body from the first support member to a portion of the second support member;

an electrical cable disposed in the through hole to be electrically connected to the charging circuit;

an electric cable disposed on the second support member to connect the electric cable to the pin; and

a piece disposed on the head to connect the pin to the contact plate.

24. (Withdrawn) The charging apparatus according to claim 10, wherein the charging terminal comprises:

a socket formed on the second support member; and

a ball rotatably disposed in the socket and formed on the head.

25. (Withdrawn) The charging apparatus according to claim 24, wherein the charging terminal comprises:

a through hole formed to pass through the body from the first support member to a portion of the second support member;

an electrical cable disposed in the through hole to be electrically connected to the charging circuit and the contact plate; and

a conductive wire electrically connecting the electrical cable to the contact plate through the ball.

26. (Withdrawn) The charging apparatus according to claim 25, wherein the electrical wire comprises:

a metal piece disposed on the second support member to be connected to the electrical cable; and

a coupling rod disposed in the head to be electrically connected between the metal piece

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and the contact plate.

27. (Withdrawn) The charging apparatus according to claim 25, wherein the electrical wire comprises a hole formed in the ball such that the conductive wire passes through the hole to be electrically connected to the contact plate.

28. (Currently Amended) A charging apparatus used with a mobile robot, comprising:
a rechargeable battery and a plurality of contact terminals included in the mobile robot;
and

a charging unit including a terminal mounting board having a guide groove, and a
plurality of charging terminals disposed to contact corresponding ones of the contact terminals
to supply a charging current to the rechargeable battery of the mobile robot, each of the
charging terminals comprising,

a body having a conductive material having a first end moveably disposed in the
guide groove to receive the charging current, and

a head movably coupled to the body, and having a contact plate mounted on a
predetermined portion of the head and electrically connected to a second end of the conductive
material to be brought into electrical contact with a corresponding one of the contact terminals of
the mobile robot;

~~wherein respective heads of the charging terminals are bent with respect to~~
~~corresponding ones of bodies of the charging terminals in different directions when the contact~~
~~terminals of the mobile robot contact corresponding ones of the charging terminals of the~~
~~charging unit in a direction having an angle with a direction disposed on a line passing through a~~
~~center of the mobile robot and a center portion of the charging terminals; and~~

~~wherein the contact terminals are disposed in a circular direction about a center of the~~
~~mobile robot, the charging terminals comprise first and second charging terminals having a first~~
~~body with a first head and a second body with a second head, respectively, the first head of the~~
~~first charging terminal being disposed on a line having a first distance with a center thereof~~
~~passing through the center of the mobile robot and a center portion of the charging terminals~~
~~moves in a first direction with respect to the first body of the first charging terminal, and the~~

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~~second head of the second charging terminal being disposed on a line having a second distance with a center thereof passing through the center of the mobile robot and a center portion of the charging terminals moves in a second direction with respect to the second body of the second charging terminal.~~

29. (Cancelled)

30. (Cancelled)

31. (New) The charging apparatus according to claim 28, wherein respective heads of the charging terminals are bent with respect to corresponding ones of bodies of the charging terminals in different directions when the contact terminals of the mobile robot contact corresponding ones of the charging terminals of the charging unit in a direction having an angle with a direction disposed on a line passing through a center of the mobile robot and a center portion of the charging terminals

32. (New) The charging apparatus according to claim 28, wherein the contact terminals are disposed in a circular direction about a center of the mobile robot, the charging terminals comprise first and second charging terminals having a first body with a first head and a second body with a second head, respectively, the first head of the first charging terminal being disposed on a line having a first distance with a center thereof passing through the center of the mobile robot and a center portion of the charging terminals moves in a first direction with respect to the first body of the first charging terminal, and the second head of the second charging terminal being disposed on a line having a second distance with a center thereof passing through the center of the mobile robot and a center portion of the charging terminals moves in a second direction with respect to the second body of the second charging terminal